General Aptitude (GA)

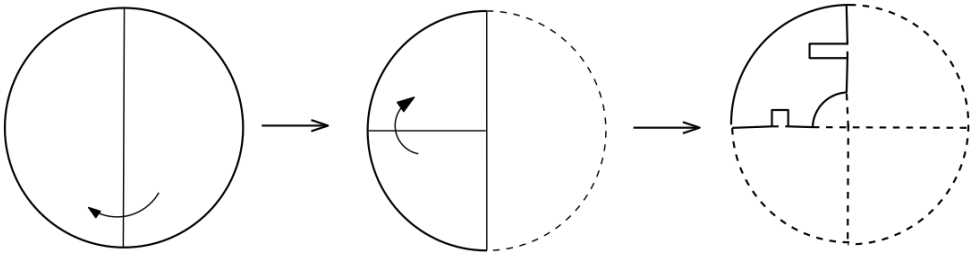
Q.1 – Q.5 Multiple Choice Question (MCQ), carry ONE mark each (for each wrong answer: – 1/3).

Q.1	**The ratio of boys to girls in a class is 7 to 3.** **Among the options below, an acceptable value for the total number of students in the class is:**
(A)	21
(B)	37
(C)	50
(D)	73

Q.2	**A polygon is convex if, for every pair of points, P and Q belonging to the polygon, the line segment PQ lies completely inside or on the polygon.** **Which one of the following is <u>NOT</u> a convex polygon?**
(A)	
(B)	
(C)	
(D)	

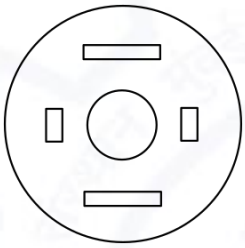
Q.3	**Consider the following sentences:** **(i) Everybody in the class is prepared for the exam.** **(ii) Babu invited Danish to his home because he enjoys playing chess.** **Which of the following is the CORRECT observation about the above two sentences?**
(A)	(i) is grammatically correct and (ii) is unambiguous
(B)	(i) is grammatically incorrect and (ii) is unambiguous
(C)	(i) is grammatically correct and (ii) is ambiguous
(D)	(i) is grammatically incorrect and (ii) is ambiguous

Q.4

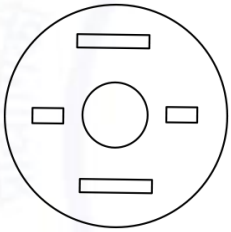


A circular sheet of paper is folded along the lines in the directions shown. The paper, after being punched in the final folded state as shown and unfolded in the reverse order of folding, will look like _____.

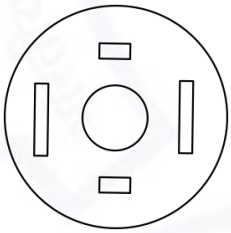
(A)



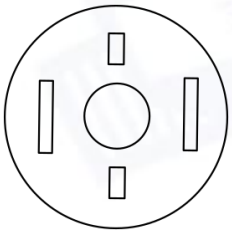
(B)



(C)



(D)



Q.5	**_____ is to *surgery* as *writer* is to _____** **Which one of the following options maintains a similar logical relation in the above sentence?**
(A)	Plan, outline
(B)	Hospital, library
(C)	Doctor, book
(D)	Medicine, grammar

Q. 6 – Q. 10 Multiple Choice Question (MCQ), carry TWO marks each (for each wrong answer: – 2/3).

Q.6	**We have 2 rectangular sheets of paper, M and N, of dimensions 6 cm x 1 cm each. Sheet M is rolled to form an open cylinder by bringing the short edges of the sheet together. Sheet N is cut into equal square patches and assembled to form the largest possible closed cube. Assuming the ends of the cylinder are closed, the ratio of the volume of the cylinder to that of the cube is _____**
(A)	$\frac{\pi}{2}$
(B)	$\frac{3}{\pi}$
(C)	$\frac{9}{\pi}$
(D)	3π

Q.7

Items	Cost (₹)	Profit %	Marked Price (₹)
P	5,400	---	5,860
Q	---	25	10,000

Details of prices of two items P and Q are presented in the above table. The ratio of cost of item P to cost of item Q is 3:4. Discount is calculated as the difference between the marked price and the selling price. The profit percentage is calculated as the ratio of the difference between selling price and cost, to the cost ($\text{Profit}\ \% = \frac{\text{Selling price} - \text{Cost}}{\text{Cost}} \times 100$).

The discount on item Q, as a percentage of its marked price, is _____

(A) 25

(B) 12.5

(C) 10

(D) 5

Q.8 **There are five bags each containing identical sets of ten distinct chocolates. One chocolate is picked from each bag.**

The probability that at least two chocolates are identical is _____

(A) 0.3024

(B) 0.4235

(C) 0.6976

(D) 0.8125

Q.9	**Given below are two statements 1 and 2, and two conclusions I and II.** **Statement 1: All bacteria are microorganisms.** **Statement 2: All pathogens are microorganisms.** **Conclusion I: Some pathogens are bacteria.** **Conclusion II: All pathogens are not bacteria.** **Based on the above statements and conclusions, which one of the following options is logically CORRECT?**
(A)	Only conclusion I is correct
(B)	Only conclusion II is correct
(C)	Either conclusion I or II is correct.
(D)	Neither conclusion I nor II is correct.

Q.10	**Some people suggest anti-obesity measures (AOM) such as displaying calorie information in restaurant menus. Such measures sidestep addressing the core problems that cause obesity: poverty and income inequality.** **Which one of the following statements summarizes the passage?**
(A)	The proposed AOM addresses the core problems that cause obesity.
(B)	If obesity reduces, poverty will naturally reduce, since obesity causes poverty.
(C)	AOM are addressing the core problems and are likely to succeed.
(D)	AOM are addressing the problem superficially.

Textile Engineering and Fibre Science (TF)

Q.1 – Q.13 Multiple Choice Question (MCQ), carry ONE mark each (for each wrong answer: – 1/3).

Q.1	**Let the function $f(x, y)$ be defined as** $$f(x,y) = \begin{cases} \frac{y}{\lvert y \rvert}\sqrt{2x^2 + 3y^2}, & y \neq 0 \\ 0, & y = 0. \end{cases}$$ **Then $\frac{\partial f}{\partial y}(0,0)$ is equal to**
(A)	$\sqrt{2}$
(B)	$\sqrt{3}$
(C)	0
(D)	1

Q.2	**If a continuous random variable X has the following probability density function** $$g(x) = \begin{cases} \frac{k}{4}x(2-x), & 0 < x < 2 \\ 0, & \text{otherwise}, \end{cases}$$ **then the value of k is**
(A)	1
(B)	2
(C)	3
(D)	4

Q.3	**The smallest positive real number λ, for which the following problem** $$y''(x) + \lambda\, y(x) = 0,$$ $$y'(0) = 0, \qquad y(1) = 0$$ **has non-zero solution, is**
(A)	π^2
(B)	$\frac{\pi^2}{2}$
(C)	$\frac{\pi^2}{4}$
(D)	$\frac{\pi^2}{8}$

Q.4	**The gummy substance present in raw silk fibre is**
(A)	Serine
(B)	Fibroin
(C)	Keratin
(D)	Sericin

Q.5	**The technique used for producing viscose rayon is**
(A)	Melt spinning
(B)	Wet spinning
(C)	Dry spinning
(D)	Dry-jet wet spinning

Q.6	**The yarn manufacturing technology that uses perforated drums for twisting is**
(A)	Ring spinning
(B)	Rotor spinning
(C)	Friction spinning
(D)	Air-jet spinning

Q.7	**In roving frame, the distance between top and bottom aprons at the exit point is maintained by**
(A)	Spacer
(B)	Trumpet
(C)	Condenser
(D)	Pressure-bar

Q.8	**Fabric structure related to weft knitting is**
(A)	Locknit
(B)	Reverse locknit
(C)	Double tricot
(D)	1×1 Rib

Q.9	The nonwoven technology which uses high-pressure water jets is
(A)	Needlepunching
(B)	Spunlacing
(C)	Spunbonding
(D)	Meltblowing

Q.10	Cotton fibre length variation can be expressed by
(A)	Uniformity index
(B)	Limit irregularity
(C)	U%
(D)	Index of irregularity

Q.11	A high value of drape coefficient indicates
(A)	Limp fabric
(B)	Stiff fabric
(C)	Compressible fabric
(D)	Smooth fabric

Q.12	The process for removal of protruding fibres from fabric surface is
(A)	Desizing
(B)	Scouring
(C)	Souring
(D)	Singeing

Q.13	**Dimethylol dihydroxy ethylene urea (DMDHEU) is a**
(A)	Crease-resist agent
(B)	Flame retardant
(C)	Softener
(D)	Soil repellent

Q.14 – Q.25 Numerical Answer Type (NAT), carry ONE mark each (no negative marks).

Q.14	**Suppose** $u(x,t) = \frac{1}{2}[g(x+ct) + g(x-ct)]$ **is a solution of the following initial value problem of the wave equation** $$u_{tt} = 9\,u_{xx}, \quad u(x,0) = g(x), \qquad u_t(x,0) = 0.$$ **Then the value of** c^2 **is _____.**

Q.15	**If the numerical solution of the initial value problem** $$y' = \frac{t^2}{t+y^3}, \quad y(0) = 1,$$ **is obtained by the Euler's method with step size of** 0.2**, then the value of** $y(0.4)$**, (*rounded off to two decimal places*), is _____.**

Q.16	**Assuming the atomic mass of H=1, C=12, N=14 and O=16, the molecular mass of a repeat unit of Nylon 6 fibre is _____.**

Q.17	**A textile filament records a tensile stress of 0.3 GPa at a tensile strain of 0.04. Assuming Hookean behavior, the tensile modulus (GPa) of the filament, (*rounded off to one decimal place*), is _____.**

Q.18	**Number of fibres, each of 40 mm length and 0.16 tex fineness, in a tuft of 24 mg mass is _____.**

Q.19	**Twist (turns per inch) of a cotton yarn of 36 Ne count produced with a twist multiplier of 3.5 inch^{-1}·Ne$^{-0.5}$ is _____.**

Q.20	**In winding, if traverse speed and package surface speed are the same, the angle of wind (in degree) is _____.**

Q.21	**During air-jet weft insertion, if the diameter of the yarn increases by 20 % then the percentage increase in drag force acting on the yarn would be _____.**

Q.22	**If the ratio of the linear densities (denier) of two circular fibers is 3, the corresponding ratio of their diameters, (*rounded off to two decimal places*), is _____.**

Q.23	**If the sample size (n) is 25 and the standard deviation (σ) of population is 2, then the standard error (SE) of sample mean, (*rounded off to one decimal place*), is _____.**

Q.24	**The wet expression for a padding mangle is set at 80 %. If the add-on of a flame retardant chemical required on the fabric is 2 % then the concentration (g/L) of the chemical in the pad bath is _____.**

Q.25	**Assuming Beer-Lambert law is applicable for dilute solutions, if the molar concentration of dye in the solution is doubled then the percentage increase in absorbance would be _____.**

Q.26 – Q.41 Multiple Choice Question (MCQ), carry TWO mark each (for each wrong answer: – 2/3).

Q.26	**The value of a, for which the following system of equations** $$2x + y + 3z = a, \qquad x + z = 2, \qquad y + z = 2$$ **is consistent, is**
(A)	6
(B)	4
(C)	3
(D)	2

Q.27	**If the function $f(x, y)$ is defined by** $$f(x, y) = x^3 - \frac{3}{2}x^2y^2 + y^3, \qquad x, y \in \mathbb{R},$$ **then**
(A)	Neither $(0, 0)$ nor $(1, 1)$ is a critical point
(B)	$(0, 0)$ is a critical point but $(1, 1)$ is NOT a critical point
(C)	$(0, 0)$ is NOT a critical point but $(1, 1)$ is a critical point
(D)	$(0, 0)$ and $(1, 1)$ are both critical points

Q.28	**Determine the correctness or otherwise of the following Assertion [a] and Reason [r]** **Assertion: Draw texturing of isotactic polypropylene (POY) at a relatively high speed is possible despite high crystallinity of the feeder yarn.** **Reason: Isotactic polypropylene (POY) has majorly smectic mesomorphic phase.**
(A)	Both [a] and [r] are true and [r] is the correct reason for [a]
(B)	Both [a] and [r] are true but [r] is not the correct reason for [a]
(C)	Both [a] and [r] are false
(D)	[a] is true but [r] is false

Q.29	**Group I gives a list of fibres and Group II contains their applications. Match the fibre with its application.** **Group I** — **Group II** **P. Polypropylene** — **1. Mountaineering rope** **Q. Kevlar** — **2. Firefighter's suit** **R. Nylon 6, 6** — **3. Bulletproof jacket** **S. Nomex** — **4. Geotextiles**
(A)	P-1, Q-4, R-2, S-3
(B)	P-4, Q-3, R-1, S-2
(C)	P-4, Q-2, R-1, S-3
(D)	P-1, Q-3, R-4, S-2

Q.30	**Techniques used for determination of orientation in fibres from amongst the followings are** **P Birefringence measurement** **Q Scanning electron microscopy** **R X-ray diffraction** **S Differential scanning calorimetry**
(A)	P and Q
(B)	P and R
(C)	Q and R
(D)	Q and S

Q.31	**In a modern high performance blowroom line, the correct sequence of machines is**
(A)	Automatic bale opener → Blender → Coarse cleaner → Fine cleaner
(B)	Automatic bale opener → Blender → Fine cleaner → Coarse cleaner
(C)	Automatic bale opener → Coarse cleaner → Fine cleaner → Blender
(D)	Automatic bale opener → Coarse cleaner → Blender → Fine cleaner

Q.32	As compared to cylinder, doffer has
(A)	Lower rotational speed and lower wire point density
(B)	Lower rotational speed and higher wire point density
(C)	Higher rotational speed and lower wire point density
(D)	Higher rotational speed and higher wire point density

Q.33	Assuming no fibre loss in draw frame, if draft is equal to doubling then the delivered sliver, as compared to fed sliver, will exhibit
(A)	Decreased mass variation and higher linear density
(B)	Increased mass variation and lower linear density
(C)	Improved fibre orientation without change in linear density
(D)	Poor fibre orientation without change in linear density

Q.34	Group I gives a list of loom motions and Group II contains loom systems. Match the motion from Group I with the corresponding system from Group II. **Group I** — **Group II** **P. Shedding** — **1. Matched cam** **Q. Picking** — **2. Seven wheel** **R. Beat-up** — **3. Rapier** **S. Take-up** — **4. Jacquard**
(A)	P-1, Q-3, R-4, S-2
(B)	P-4, Q-3, R-2, S-1
(C)	P-4, Q-3, R-1, S-2
(D)	P-3, Q-4, R-1, S-2

Q.35	**Group I gives a list of terms related to woven fabrics and Group II contains equivalent terms related to knitted fabrics. Match the term from Group I with the equivalent term from Group II.** **Group I** — **Group II** **P. Cover** — **1. Interlock** **Q. Double-cloth** — **2. Wales** **R. Warp** — **3. Tightness** **S. Weft** — **4. Courses**
(A)	P-3, Q-1, R-4, S-2
(B)	P-3, Q-1, R-2, S-4
(C)	P-1, Q-3, R-2, S-4
(D)	P-1, Q-3, R-4, S-2

Q.36	**Determine the correctness or otherwise of the following Assertion [a] and Reason [r]** **Assertion: In shuttle loom, late shedding is preferred for filament weaving.** **Reason: In late shedding, the timing of shed dwell matches with the timing of shuttle travel through the shed, and therefore, it minimises the rubbing of warp yarns.**
(A)	Both [a] and [r] are true and [r] is the correct reason for [a]
(B)	Both [a] and [r] are true and [r] is not the correct reason for [a]
(C)	Both [a] and [r] are false
(D)	[a] is true but [r] is false

Q.37	**The typical shapes of comb sorter diagram and fibrogram of polyester fibres of equal cut length will be**
(A)	Triangular and rectangular respectively
(B)	Rectangular and triangular respectively
(C)	Rectangular and S-shaped respectively
(D)	S-shaped and triangular respectively

Q.38	In Classimat system, the yarn fault H2, as compared to yarn fault C3, is
(A)	Thicker and longer
(B)	Thicker and shorter
(C)	Thinner and longer
(D)	Thinner and shorter

Q.39	**Determine the correctness or otherwise of the following Assertion [a] and Reason [r]** **Assertion: Application of an optical brightening agent makes the white fabrics appear brighter.** **Reason: Optical brightening agents absorb energy in the visible region and radiate back in the UV region.**
(A)	Both [a] and [r] are true and [r] is the correct reason for [a]
(B)	Both [a] and [r] are true and [r] is not the correct reason for [a]
(C)	Both [a] and [r] are false
(D)	[a] is true but [r] is false

Q.40	**Determine the correctness or otherwise of the following Assertion [a] and Reason [r]** **Assertion: Nylon is dyed with acid dyes in the acidic medium.** **Reason: Nylon assumes positive charge in the acidic medium and thus, attracts the negatively charged acid dye molecules.**
(A)	Both [a] and [r] are true and [r] is the correct reason for [a]
(B)	Both [a] and [r] are true and [r] is not the correct reason for [a]
(C)	Both [a] and [r] are false
(D)	[a] is true but [r] is false

Q.41	**Determine the correctness or otherwise of the following Assertion [a] and Reason [r]** **Assertion: Discharge printing of dyed polyester fabric is not possible.** **Reason: The discharging agents damage the polyester fibres significantly.**
(A)	Both [a] and [r] are true and [r] is the correct reason for [a]
(B)	Both [a] and [r] are true and [r] is not the correct reason for [a]
(C)	Both [a] and [r] are false
(D)	[a] is true but [r] is false

Q.42 – Q.55 Numerical Answer Type (NAT), carry TWO mark each (no negative marks).

Q.42	**If 3 and 6 are eigenvalues of the matrix** $\begin{pmatrix} 5 & 2 & 0 \\ 2 & \mu & 0 \\ -3 & 4 & 6 \end{pmatrix}$ **then the value of μ is _____.**
Q.43	**If $y(x)$ is a solution of** $x^2y'' - 4\,x\,y' + 6\,y = 0, \quad y(-1) = 1, \quad y'(-1) = 0.$ **Then the value of $y(2)$ is _____.**
Q.44	**In melt spinning, the mass throughput rate of polymer is 210 g/min, the winding speed is 3000 m/min, and the linear density of the yarn produced is 200 denier. The effective draw ratio, (*rounded off to two decimal places*), is _____.**
Q.45	**The molecular weight (M) of a polymer is determined from Mark-Houwink Equation by using coefficient $K = 11.5\times10^{-3}$ ml/g and exponent $a = 0.73$. If the measured intrinsic viscosity [η] of the solution is 6.0×10^{2} ml/g then the value of $M\times10^{-6}$, (*rounded off to two decimal places*), is _____.**
Q.46	**A roving of 2 Ne count is fed to a ringframe set with a mechanical draft of 30. If the length of the drafted strand delivered from the nip of the front rollers is reduced by 3 % due to twist then the count (Ne) of the yarn, (*rounded off to one decimal place*), is _____.**
Q.47	**In a 3 over 3 drafting arrangement, the diameter of all bottom rollers is 28 mm. The back zone draft is 1.3 and the front zone draft is 6. If the back bottom roller is eccentric then the wavelength (mm) of the resulting fault in the drawn sliver, (*rounded off to two decimal places*), is _____.**

Q.48	**For a given woven fabric, fractional cover is 0.5 for both warp and weft. The fractional cover of the fabric, (*rounded off to two decimal places*), is _____.**

Q.49	**For a shuttle loom, producing plain woven fabric, if each of the dwell periods of the shedding cam corresponds to one-third of crank shaft rotation, the sum of the two dwell periods of the cam (in degree) is _____.**

Q.50	**If the moisture regain (%) and moisture content (%) of a fibre are the same then the value of moisture regain (%) is _____.**

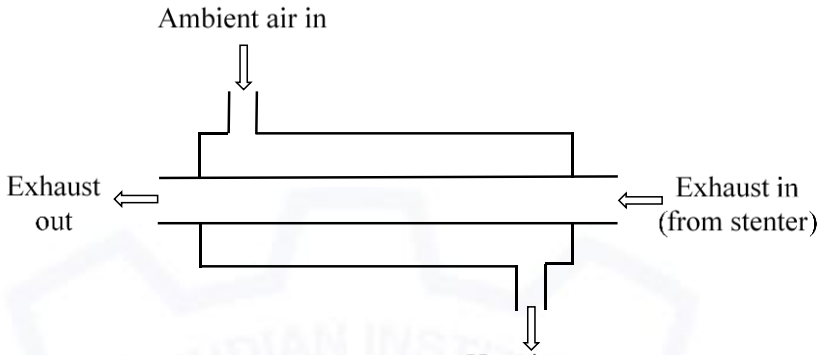
Q.51	**Mass of 120 yards of cotton yarn is 3 g. The count (Ne) of yarn, (*rounded off to one decimal place*), is _____.**

Q.52	**A woven fabric with areal density of 300 g/m^2 is tested by strip tensile test method, keeping the specimen width as 5 cm and gauge length as 25 cm. If the breaking load is 900 N, the tenacity (cN/tex) of the fabric is _____.**

Q.53	**A 50 tex yarn with mass CV of 12.5 % is produced from staple polyester fibres each of 4.5 denier fineness. The index of irregularity of the yarn, (*rounded off to two decimal places*), is _____.**

Q.54

A counter-flow heat exchanger is attached to a stenter for waste heat recovery.



HEAT EXCHANGER

Consider the following data:

Ambient temperature : 30 °C

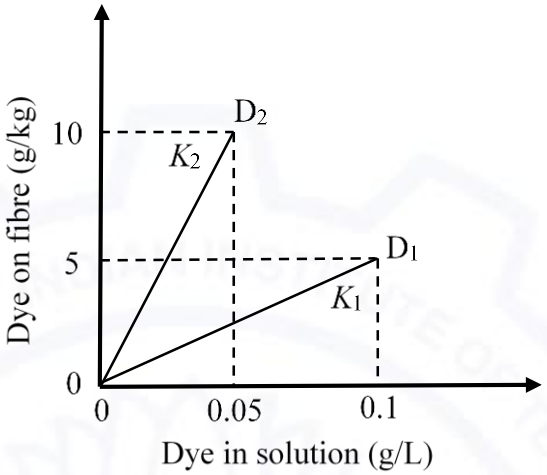
Temperature of exhaust from stenter : 150 °C

Temperature of exhaust at exit of heat exchanger : 100 °C

Specific heat of exhaust : 0.42 kcal·deg^{-1}·kg^{-1}

Specific heat of air : 0.24 kcal·deg^{-1}·kg^{-1}

At steady state, if the mass flow rates of the exhaust gas and the incoming air are the same, assuming heat loss as zero, the temperature (°C) of the air at the exit of the heat exchanger (towards the stenter), (*rounded off to one decimal place*), is_____.

Q.55	**Consider the following isotherms at equilibrium for two disperse dyes D_1 and D_2 dyed on polyester. If the partition coefficients of these are K_1 and K_2, respectively, the value of $\frac{K_2}{K_1}$ is _____.** 

END OF THE QUESTION PAPER